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Photocatalytic Water Splitting: Using a 2-Photon Tandem Approach

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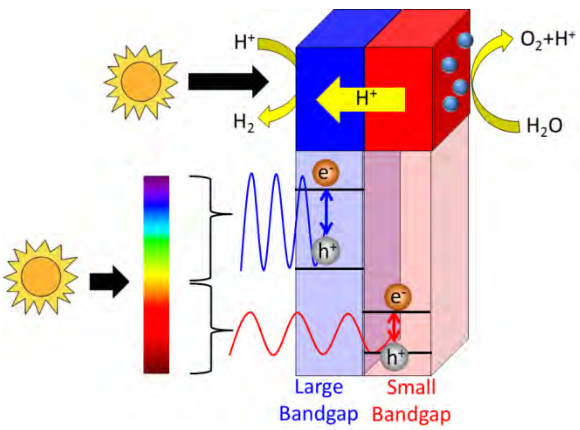
Currently the world uses 17 TW of energy, with ~85% of that coming from fossil fuels. The solar irradiation that strikes earth is 120,000 TW, thus we only need to capture a fraction of this. However the greatest issue with solar energy from a practical and economic standpoint is its intermittency. (The sun doesn't shine at night.) This means storing solar based energy is just as important as harvesting it. As biological processes have proven, a very efficient way of storing energy is in the form of chemical bonds. The electrolysis of water into hydrogen and oxygen is an excellent way to store energy since water is a plentiful resource, hydrogen is an extremely energy dense molecule (by weight), and the oxygen by-produce can be discarded to the atmosphere.

Rather than use a solar cell and an electrolyzer separately, we can combine these devices thus minimizing capital costs. This talk will focus on how we construct a photoelectolyzer that is both highly efficient and highly durable in the corrosive environments needed for water splitting. Our focus is to use 2-photon tandem solar cells with transparent, conductive protective coatings to allow for highly efficient photoelectrolyzers. Figure 1A and 1B shows the general design of our approach to photoelectrolysis. While there are many parts to the device we are focusing on all of these in our quest to make a 20% efficient solar to hydrogen device. This talk will discuss what materials we use for both the large band gap and small band gap photoabsorber as well as our recent improvements in catalytic efficiency for both the H_2 evolution and O_2 evolution reaction.

1 A)



1 B)